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Time to Reflect



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Anyway, it was a very good year. If you browse through a dictionary of quotations, there is perhaps no subject so well-represented as the subject of time. By far the majority bemoan the passage of time or, more particularly, the speed of its passage. None is more apposite to the life of a German professor than, “But at my back I always hear, Time's winged chariot hurrying near”.

Somehow my twenty years in Freiburg had flown by. The job of administering science as well as doing it, of trying to build up a theoretical atomic physics in Germany where there was none, had left me with no space in which to consider in depth a basic question that had troubled me since my student days, namely, the role of time in quantum mechanics. Hence the chance to catch my breath in Wiko and to sit down and think about this subject was a godsend, even though those same pressures had caused me to have to postpone the start of the programme by twelve months. Nevertheless, in October 1998, the study group on “The Meaning of Time in Quantum Theory” convened in Berlin. Of course, the trouble with Wiko is that the time seemed to pass too quickly. And in this last phrase is the key to my thinking on time. Our perception of the passage of time comes only from changes in spatial relationships, brought about or observed by interaction between ourselves and the rest of the universe. Quite how to formulate this mathematically is another question and a year in the monastery of Wiko was just the perfect setting for pondering such

mysteries. Of course, in physics we are used to working in teams, so it was essential to the success of our programme that two other novices, Lajos Diósi and Jan-Michael Rost, were also initiated at the same time. In addition, the pastoral visits of Martin Gutzwiller, perhaps the Pope of semi-classical quantum mechanics, stimulated us all immeasurably. In thumbing through the reports of Fellows of previous years, one is struck by how often it is commented that the goals which they set themselves were not achieved, usually having been sacrificed to excessive participation in Berlin's cultural life. In my case the opposite is true, I achieved more than I imagined at the outset but this was only achieved by not participating in the cultural activities of Berlin. In this sense my departure was not tinged with regret, it was positively soaked in it. So much of what I had wanted to do and see in Berlin was left undone and unseen.

The shackles that tie one to a Chair at a German university are not loosened easily and although the physicists at Wiko organised a full programme of discussions and seminars, the period before Christmas involved frequent forays to Freiburg to look after students there and to finish my commitment to the Deutsche Forschungsgemeinschaft. The period between New Year and April was the period of intense study and saw the group members enter a more monastic mode, a state which for me is totally uncharacteristic. The days of the grey Berlin winter were spent wrestling with the formulation of the time-energy uncertainty relationship, the role of time in relativistic quantum theory and related matters. Hours were spent discussing and arguing with Rost on these questions. At night I ploughed through the enormous physical and philosophical literature on the subject of time. With the help of the librarians, I was able to research the original literature on our notion of motion in atoms and to prepare my Tuesday seminar on the question "does time exist for stable atomic systems?" My cultural activity at this time was limited to watching rugby games from England in the Irish pub on Olivaer Platz on Saturday afternoons.

My recreational activity was limited to jogging in the Grunewald. I quickly learned that the only possible place to run was in the area of the forest to the right of the Koenigsallee, this area being populated by only a few feral humans. The area to the left, surrounding the Grunewaldsee, had long been firmly in the hands of the canine race and only once, when the Hann's dog invited Chris and me to run there, did I dare to venture into their territory. Quite literally there were far more dogs than humans and it was amazing to see how they had even organised their own *Strandbad* there. These runs in the forest gave time for quiet contemplation and helped to remove at least some of the legendary Wiko extra kilos. One result of these contemplations was parts of the paper "Time Dependence in Quantum Mechanics", which Rost and I completed around the end of

March. Although it consists of only a few pages, it took weeks to conceive and went through about twenty iterations. If nothing else emerges from the year, that paper made it worthwhile, since it seeks to tear up chapter 1 of just about every book written on quantum mechanics. Naturally, it is proving controversial and, at the time I write this, is still with the referees.

April was the climax of the group's year when we ran a mini-workshop, Martin Gutzwiller was back, Claus Kiefer joined us and Wiko were kind enough to sponsor three visitors. Particularly our guest Julian Barbour, who has thought deeply about time for a long time, was a delight to have with us. Many happy evenings were spent discussing physics over glasses of *Schwarzbier* in the pubs around the Grunewald S-Bahnhof. From this time the group's activities broadened to look at the fundamental question of the emergence of time in quantum gravity and "the equation of the universe". Claus Kiefer gave a stimulating series of lectures which opened many avenues of research.

June was a more relaxing month and I was busy giving lectures throughout the Berlin area. Particularly rewarding was the public evening lecture at Urania e.V., Berlin. Nearly three hundred people, of all ages and from all walks of life, listened intently for an hour and then proceeded to question me for more than two hours – the discussion spilling out onto the pavement after the building was closed. I was taken aback and quite amazed at this reaction from the general public. Certainly it was worth all the effort of trying to put together a physics lecture for general consumption. I do not know if any other Fellows held Urania lectures, but if not I find it a pity. Of course we have Thursday evening Wiko lectures but these are for intellectuals; reaching out to the general public is especially rewarding and would refute the charge of intellectual snobbery that is sometimes made against the Kolleg.

Of course I have to acknowledge not only that Wiko is a wonderful place to work and study but also that the staff are cheerful and helpful. Particularly I have to mention Hans-Georg Lindenberg in the *EDV-Abteilung* and the assistance of Petra Sonnenberg who composed the manuscript of my Urania lecture, she was always patient with my impatience. The Tuesday seminars I viewed with mixed feelings – as a natural scientist I felt that the "two cultures" were often evident. I had difficulty seeing the point of much of the research of the "arts people". Conversely, I felt that they had trouble appreciating what I was trying to do, or even why. This is certainly not to say that the idea of bringing together scholars of different disciplines should be abandoned, the fault no doubt lies with me, in that I should have made more effort to communicate, although this is hard when one is buried in one's own problems. The Time simply passed too quickly. Anyway, it was a very good year.